CHARACTERIZATION OF HIGH TEMPERATURE-TREATED NANOSTRUCTURED CARBONS FROM SELF-ASSEMBLED BLOCK COPOLYMER PRECURSORS

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Abstract

Nanostructured carbons with controlled morphology (nanocarbons) are promising materials for use in a number of devices. Arrays of carbon dots and vertical cylinders would be ideal for use in field-emission arrays [1], and highly porous nanoscale carbon materials are promising candidates for supercapacitor electrodes [2]. Recent findings have shown that it is possible to stabilize nanoscale thin-film morphology of phase-separated block copolymers with polyacrylonitrile (PAN) blocks, and to convert these materials, by pyrolysis, into carbons with well-defined nanostructure [3,4]. This presentation will describe the effects of further high-temperature treatment of nanocarbons aimed at their graphitization.

Nanocarbon samples were obtained from PAN homopolymers or PAN-containing block copolymers which were assembled inside the channels of ordered nanoporous silica templates [4]. PAN was then converted to carbon via stabilization under air and subsequent pyrolysis under inert atmosphere at 800°C. The resulting materials exhibited well defined nanoscale morphology, replicating the channels within the silica template (Figure 1) [4]. Further graphitization was carried out by heating in a graphite furnace (Centorr/Vacuum Industries Inc., Model HP-2058) at 2200 °C in a 5 psi argon atmosphere for 1 hour. Gas adsorption analysis revealed that the graphitized samples retained appreciable specific surface area and pore volume, whereas x-ray diffraction and preliminary TEM analysis provided the indications of the improved atomic scale ordering.

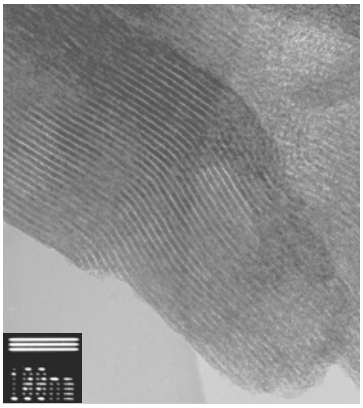

Figure 1. TEM image of ordered nanocarbon obtained by stabilization and 800 ^{o}C pyrolysis of PAN assembled inside the channels of ordered nanoporous silica template.

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